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## Smartphone-assisted neuroendoscopy

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Several high-definition neuroendoscopes are commercially available, which have been valuable for achieving optimal results in less invasive surgery, but the smartphone revolution has now presented advanced technology and methodology. The integration of smartphone technology into endoscopy for performing minimally invasive neurosurgery is one of its latest applications, and one that has experienced no hitches, with surgeons having found it easier and more intuitive to navigate within the ventricles by using this method.

In a recently published paper, Dr. Mauricio Mandel and colleagues from São Paulo, Brazil, describe the smartphone-endoscope device they applied to minimally invasive neurosurgery (Mandel et al. 2018). In addition to finding the device easy to use, the authors concluded it was efficient, cost-effective, and a great learning tool for less experienced neurosurgeons.

The new endoscopic system was used by the authors in the minimally invasive surgical treatment of 42 patients with various neuropathological disorders. The patient population consisted of 20 male and 22 female patients, with a mean age of 40.7 years (range 1–68 years). All procedures were successfully performed, and no complications related to the use of the new method were observed. Dr. Mandel and colleagues believe this is the first such study in medical literature and may represent a low-cost and more intuitive solution for minimally invasive procedures in neurosurgery.

## Enhanced endoscope usability

The introduction of the smartphone realigns the surgeon's view directly to the endoscope—as opposed to techniques that require the user to look over the screen on one side and manoeuvre the endoscope on the other, which is unnatural behaviour for the brain. Because the smartphone screen moves along with the endoscope, surgical mobility was enhanced with the use of this method, observed Dr. Mandel et al. This increased mobility was identified as the greatest benefit of the use of the smartphone-endoscope system compared with the use of the neuroendoscope with the standard video set. The surgeons in this study were comfortable with using this new methodology and never needed to return to the technique they were more used to.

Furthermore, the smartphone-endoscope device used in this study was easy to set up and offered the ability to manipulate the image by using the smartphone camera functions in real time. In this study, the surgeons used a neuroendoscope modified to be coupled with an iPhone (Apple Inc.) by the addition of a specially designed adaptor. The lens system used in this study can be used to simply connect any smartphone to an endoscope.

## Communication function

As high-quality computerised communication devices with in-built digital cameras, it's no wonder smartphones are being increasingly used in medical care. And the communicative feature of these devices puts them above available neuroendoscopes. Not only does the smartphone-endoscope device offer improved video function and usability, but it also allows an exceptional image quality with 4K resolution to be transmitted using wifi to a larger display in the operating room, which can be observed by the assistant surgeon.

Although some currently available neuroendoscopes can record still images and video through the use of camera systems attached to the endoscopic tube, these instruments are typically more expensive than smartphones. Standard video systems included with endoscopes are also larger than mobile phones, not as widely available, and lack the telecommunication and data collection capabilities unique to a mobile phone.

Minimally invasive approaches are the new frontier in neurosurgery, and this smartphone-endoscopy integration has pushed capabilities to the next stage. This innovative use of smartphone technology could also have a significant impact in underserved areas and in developing countries where healthcare infrastructure is limited.

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